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# PHYSICAL PROPERTIES AND SENSORY EVALUATION OF ICE CREAM FORTIFIED WITH CICHORIUM PUMILUM, JACQ CRUDE EXTRACT

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## ABSTRACT

The genus Cichorium has a rich history of use in folklore and is widely eaten by the farmers. It is also widely used medicinally to treat various ailments ranging from wounds to diabetes. It was discovered that the root of Cichorium contained up to 40% inulin, which has a negligible impact on blood sugar and thus is suitable for diabetics, the crude extract prepared from cichorium had satisfactory proteolytic activities which offers a practical way to reduce its antigenic protein fractions.

In this study we investigated the effects of fortified milk (that is used in ice cream manufacture) with Cichorium crude extract (CCA) on the physical and sensory properties of the resulting ice cream.

## INTRODUCTION

Dietary factors are implicated in the etiology of a number of chronic degenerative diseases (Harrigan, 1989; Haumann, 1986). Health-conscious consumers continue to look for ways to improve nutritional habits without sacrificing psychological satisfaction (Kostias, 1997; O'Brien, 2003; Plug, 1993).

Ice cream is a frozen foam that consists of air cells dispersed in an aqueous matrix (Marshall et al., 2003). The three main structural components of ice cream are air cells, ice crystals, and fat globules, which are distributed throughout a continuous phase of unfrozen solution (serum). Overall, consumers are quite concerned with the influence of diet on health. Eating ice cream has great benefits such as increasing insulin secretion and increasing the gut hormone glucagon-like peptide-1 (GLP-1) which is an important regulator of glucose homeostasis and energy balance through its concerted actions on appetite, Hans (2008), but ice cream, have been considered to increase the risk for allergy since beta-lactoglobulin can induce milk allergy (Kim et al 2007). Enzymatic hydrolysis of milk whey protein offers a practical way to reduce its antigenic protein fractions (Kim et al 2007 and Hai et al 2008), Our previous study found that Cichorium crude extract (CCPE) has proteolytic activity, Nadia (2015).

Cichorium intybus is a medicinally important plant in Eurasia and in parts of Africa. Several studies have been conducted on grazing animals to determine the antihelmintic potential oF Cichorium . In the majority of the experiments, the condensed tannins and sesquiterpene lactones were responsible for the anthelmintic activity [D.Mares et al 2011]. It was discovered that the root of Cichorium contained up to 40% inulin, which has a negligible impact on blood sugar and thus is suitable for diabetics [A. Judˇzentien˙e andJ.B.udien˙e2008], The methanolic extract displays wound healing effect and $\beta$-sitosterol was determined as the active compound responsible for the activity, possibly due to its significa The crude ethanolic extract of C. roots caused a significant inhibition of Ehrlich tumor carcinoma in mice. A 70% increase in the life span was observed with a 500mg/kg/day intraperitoneal dose of the tested extract [B. Hazra et al 2002]. Cichorium crude extracts have anti-inflammatory and antioxidant effects, as well as hyaluronidase and collagenase inhibition [I. S¨untar et al 2012]. Cichorium crude aqueous and organic seed extracts were found to be active against four pathogenic microorganisms, namely: Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, and Candida albicans, and root extracts had pronounced effects on Bacillus subtilis, S. aureus, Salmonella typhi, Micrococcus luteus, and E. coli [I. S¨untar et al 2012, S. Nandagopal 2007]. The flowers of chicory contain saccharides, methoxycoumarin cichorine, flavonoids, essential oils [A. Judˇzentien˙e andJ.B.udien˙e2008]. The leaf extract of Cichorium also showed a moderate activity against multidrug resistant S. typhi [P. Rani et al 2004]. Guaianolides-rich root extracts of C. intybus have shown antifungal properties against anthropophilic fungi Trichophyton tonsurans, T. rubrum, and T. violaceum [D.Mares et al 2011]. Extraction of chicory pulp yields high levels of pectin, a polysaccharide extensively used in food as a gelling agent, thickening agent, and stabilizer [C. Robert et al 2008].

The crude protein content in chicory is more valuable than in lfalfa. Furthermore the crude lipid in chicory is generally higher than most varieties of alfalfa [Q. Wang and J. Cui, 2011]. It also has a nutritional quality comparable to lucerne, with a mineral content superior for copper and zinc, with similar proportions of protein, lipid, minerals, and other nutrients, and palatable with good digestion with applicability in the poultry and livestock industry [] M. A. Sanderson et al 2003, ] A. Scharenberg et al 2007].

Cichorium is safe for human use, The toxicity evaluation of Cichorium extracts has also been done by Vibrio fischeri bioluminesce inhibition test (Microtox acute toxicity test). This bacterial test measures the decrease in light emission from the marine luminescent bacteria V. fischeri when exposed to organic extracts. The tested extracts showed less than 20% inhibition of bioluminescence and hence were concluded to be safe for human use [F. Conforti 2008].

Fortification of the milk base is one of the most important steps that enhances functional and nutritional Properties Marie et al (2013) This research utilizes these approaches to produce ice cream fortified with cichorium crude extract to produce functional ice cream with many health benefits.

## MATERIAL AND METHODS

### Preparation of Cichorium crude extract

Dried whole plant was cut into small pieces grind , maceration 10 gm of this powder in 50 ml hot water (60 c) using an electric mixer . The extract filtered and centrifuged at 30000 rpm for 30min. The supernatant was referred as cichorium crude extract (CCA).

### Processing

Vanilla ice cream mixes were made in 3-kg batches as described by Nadia( 2008 ) Fresh bulk buffalo’s milk obtained from the farm of the Agriculture faculty ,Minufiyia Univ. ,Shibin El Kom, Egypt.

The ice cream formulations contained 12% milk fat, 16% sucrose, 0. 5% stabilizer.

Cichorium crude extract added to the pasteurized milk that will be used in ice cream manufacture at a levels of 2,4,6,8, and 10% batches named CCA2; CCA4 ; CCA6; CCA8and CCA10 respectively and kept at room temperature for four hours , then used for ice cream mix preparation. All mixes pasteurized for 30 mins. at 71°C .The mixes were then cooled and aged at 4 to 5°C for 12 h. The ice cream was frozen in a batch freezer (Cattabbriga, Bolognia, Italy) samples were tempered in a freezer at -15° for approximately 18 h.

### Ice cream analysis

#### Overrun

One overrun measurement was taken per sample by comparing the weight of ice cream mix and ice cream in a fixed volume container. Overrun (in %) was calculated as follows. A plastic whipping bowl was modified to test foam stability (Lim et al., 2008). The time to attain 50% drainage was used as an index of foam stability (Phillips et al., 1990).

$$Overrun = \frac{weight\ of\ mix - weight\ of\ ice\ cream(100)}{weight\ of\ ice\ cream}$$

#### Melting rate

A sample of ice cream was cut from the end of a rectangular half-gallon container to make a rectangular block of ice cream that weighed 100 ± 1 g. The dimensions of the sample varied slightly from one ice cream to another (6 to 7 cm x 6 to 7 cm x 3 cm) due to the differences in physical characteristics (e.g., overrun). The sample of ice cream (initially at -15°C) was placed on a wire screen (6 holes/cm) on top of a funnel that was attached to a graduated cylinder. The ice cream was placed in a controlled temperature chamber at 25°C (RH 50%). Every 5 min, for up to 3 h, the dripped volume was recorded. Pictures of the ice cream were taken with a digital camera every 20 min. The time (min) was plotted against the dripped volume (mL) and the slope of the main melting event was taken as the melting rate (Muse M. R. and. Hartel R. W,(2004).

#### Hardness

Texture analyzer CNS – (The Farnell, England) was used to measure the hardness of the ice cream at -15°C. Samples were quickly transported to the texture analyzer, held at room temperature, and analyses completed within 30 s to minimize variability due to sample warming. A 42-g stainless steel probe (60° cone with a maximum diameter of 6.5 cm) was aligned so that it touched the surface of the ice cream and then allowed to penetrate the samples under the force for five second. The forces needed for make equal penetration was directly proportional to the hardness. Three measurements were taken per sample. (Muse M. R. and. Hartel R. W, (2004).

**Sensory evaluation**

Sensory evaluation consisting of flavor & taste, body&texture, and overall acceptability was carried out by 15 panelists from dairy and food sciences departments.

**Statistical analysis**

All the obtained data were statistically analyzed by SPSS computer software according to (Abo- Allam, 2003).

**RESULTS AND DISCUSSION**

No significant difference was observed between melting resistance of samples of the different level of CCA until 4% and the control (P> 0.05) but the melting resistance of samples containing 6, 8 and 10% significantly increased (Table 1).

As can be seen from Table 1, using CCA at level 6, 8 or 10 % led to increasing hardness of the product. In this case control samples showed lower values of hardness than those with CCA. Increasing CCA level to 4% had no significant effect on hardness of samples.

The increase of instrumental hardness with increased CCA content may be attributed to the freeze concentration in their serum phase (Bolliger et al., 2000).

Viscosity values (Table 2) increased with an increase in the level of CCA but the differences were not significant until 4%. The function of CCA in ice cream preparation is considered to be related to its water binding capacity by forming a three-dimensional network of hydrated molecules throughout the system. Water retention is associated with the mobility of the free water molecules to become limited and consequently the bulk viscosity increased. In this way they retard ice crystal formation and growth, improving mix viscosity, air incorporation, body and texture as well as melting properties (Nielsen, 1978). Overrun (Table 2) significantly increased in samples contain CCA at a level above 4% with no significant differences between control and samples containing 2 and 4 %.

Sensory properties of ice cream containing CCA at five levels are presented in (Table 3). As seen from the table, using CCA at any levels until 6% did not have any negative effect on these properties and furthermore the flavor, texture, color and overall acceptability of ice cream samples containing CCA, were more appealing than control. Considering the scores of all sensory properties, the most acceptable sample was ice cream containing 6% CCA. Texture, Flavor, color and overall acceptance of ice cream containing the two levels 4and 6%

of CCA did not significantly differ (P> 0.05). Taste &flavor scores of the samples containing 8 and 10% were somehow lower than for the other samples and control. They had bitter taste.

**Table (1): Melting rate, hardness in ice creams.**

| Determinations / Samples* | Melting rate (ml/min) | Hardness(gm) (Depth of penetration 7mm) |
|---|---|---|
| C | 1.9 | 131 |
| CCA2 | 1.9 | 131 |
| CCA4 | 1.8 | 133 |
| CCA6 | 1.5 | 146 |
| CCA8 | 1.2 | 157 |
| CCA10 | 1.0 | 164 |

*C: control; CCA2; CCA4; CCA6; CCA8and CCA10: ice cream fortified with 2,4,6,8, and 10% Cichorium crude extract.

**Table (2): Apparent viscosity overrun in ice cream.**

| Determinations / Samples* | Apparent Viscosity at 20 rpm (cP) | Overrun % |
|---|---|---|
| C | 886 | 75.6 |
| CCA2 | 889 | 76.5 |
| CCA4 | 898 | 78.1 |
| CCA6 | 912 | 93.1 |
| CCA8 | 958 | 95.9 |
| CCA10 | 989 | 98.4 |

*for details see table 1

**Table (3): Organoleptic properties of ice cream.**

| Ice cream | Flavour&taste (40) | Body and texture (30) | overall acceptability (30) | Total score (100) |
|---|---|---|---|---|
| C | 40 | 28 | 28 | 96 |
| CCA 2 | 40 | 29 | 27 | 96 |
| CCA4 | 40 | 28 | 29 | 97 |
| CCA6 | 38 | 30 | 29 | 97 |
| CCA8 | 32 | 29 | 26 | 87 |
| CCA10 | 30 | 28 | 25 | 73 |

*for details see table 1

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